

Advances in Telemedicine Technology

a report by

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Jonathan D Linkous is Executive Director of the American Telemedicine Association (ATA) and, as ATA's chief staff executive since 1994, he has spoken and written extensively on policy issues, emerging applications and market trends affecting telemedicine. Mr Linkous has over 20 years of experience as a senior executive working in corporate and public sectors in the areas of medical and human services, telecommunications and economic development. Mr Linkous received a BSc degree in Business Administration from Franklin University in Columbus, Ohio, and a Masters of Public Administration from the School of Government and Public Affairs at the American University in Washington, DC with additional postgraduate work undertaken at the Lyndon B Johnson School of Public Affairs in Austin, Texas.

Telemedicine involves the transfer of medical information for use in diagnosis, treatment and education over distances. The interaction may involve two-way live audio and video visits between patients and medical professionals, sending patient-monitoring data from the home to a clinic or transmitting patient images and medical files from a primary care provider to a specialist.

Telemedicine brings medical services directly to the point of need. It can empower consumers into becoming primary providers of their own healthcare and wellness by bringing healthcare to the patient rather than the patient to the provider. By providing direct links between the general practitioner and major medical centres, telemedicine can also be used in the on-going education of the physician.

The location of the telemedicine project and the types of services in demand determine what clinical tools and telecommunications technologies are used. The type of clinical applications and the volume of consultations determine the characteristics and costs of the use of telemedicine.

Telemedicine programmes have provided care in more than 40 clinical specialty areas. The most common applications include radiology, cardiac monitoring and other forms of remote patient monitoring. Other clinical services being delivered remotely include mental health, pathology, dermatology, emergency medicine and ocular diagnostics.

Depending on the need and availability of communications infrastructure, telemedicine uses a variety of transmission modes including ISDN, T1, asynchronous transfer mode, digital subscriber line, satellite, microwave, digital wireless, local telephone lines and the Internet. The combination of equipment and transmission technology enables health providers to relate with other providers or patients using either live audio and video or through 'storing' and later 'forwarding' multimedia information such as sending e-mail.

Services such as specialist-assisted surgery or psychiatric consultations usually require the use of

live video. The use of store-and-forward technology can be more convenient and much more cost-effective except in certain areas where live transmissions are required.

Only five years ago, a 'typical' telemedicine set-up cost close to US\$300,000. Today, with improvements in technology, innovations in data compression and reductions in computing costs, the expense of the equipment required to conduct telemedical consults can be less than US\$5,000. For remote patient monitoring, the cost of some units is now less than US\$300.

Telemedicine is employed in a variety of clinical settings. Remote medical services are used in such diverse areas as providing medical care to prisons, on board commercial aircraft and ships, in the military and even at the South Pole. One of the largest users of telemedicine in the world is the Veterans Health Administration (VHA) in the US, with over 250,000 medical services provided remotely each year.

Telemedicine is often deployed as a network, linking multiple locations over areas ranging from a community to an entire nation. Such networks represent more than technology. They are building new healthcare partnerships from physicians' offices to rural clinics and hospitals, schools and home care agencies to tertiary care centres. These partnerships are becoming crucial to improving access and quality of care in healthcare systems. Successful telemedicine programmes often support clinical activities, distance learning and continuing medical education programmes across a common infrastructure using a range of technologies. Due to shortages of healthcare professionals and medical specialists in many areas, there is clearly a growing need for this type of network and its services.

The Future – Four Focal Points

Internet

The Internet has become a major factor in the delivery of healthcare. The growth of e-health has already transformed the way in which many



consumers acquire information about healthcare. The abundance of health information, the availability of online discussion forums and the new presence of e-commerce prescription medicine sites all lead to improved convenience for consumers. It allows consumers to take more control over their own healthcare. In the future, the ability of medical providers to virtually 'see' and provide online treatment plans and prescriptions for patients provides an opportunity for both traditional and non-traditional health providers to extend their reach to greater numbers of people.

Home Care

With the ageing of the population in most developing nations, 'tele-homecare' has probably one of the greatest potentials for rapid growth worldwide. In 1994, the US-based National Association for Home Care (NAHC) estimated that 15,000 providers delivered care to seven million individuals requiring in-home services due to acute illness and long-term health conditions. Increasingly, hospital technology is relocating to the home. While home telehealth creates advantages in terms of cost savings, it also presents challenges for device manufacturers, untrained users and patients. With more technologies moving into home care and more and sicker patients being treated outside of the hospital environment, the home care approach to healthcare is here to stay.

Ageing patterns across Europe closely resemble the US trend and, in Asia, the rapidly changing demographic characteristics and the tradition for caring for elders at home creates a challenge and a unique opportunity for the implementation of tele-homecare.

Remote Surgery

What was considered science fiction just ten years ago – robotic surgery, guided by a surgeon located many miles away – has now become a reality. Used

for surgical training as well as remotely controlled, minimally invasive laproscopic surgery, such systems are now widely in use with more than 1,000 robotic surgical systems worldwide. Most systems are operated with the surgeon located in the same room. Demonstrations of the remote use of robotic surgery, initially demonstrated as recently as 2001, are now used as part of regular surgical rotation in at least one hospital in Canada performing remote surgeries on patients many miles away. In the future, such applications may allow training of new procedures to surgeons around the world and extend access to physicians able to perform complicated surgery.

Computer Diagnoses

Using computer-based algorithms to analyse, assess and even prescribe treatment based on the patient's vital signs is now in limited use in several clinical areas. Closely related to telemedicine, such advances can improve the accuracy of diagnoses, reduce the cost of medical care and potentially extend access to populations around the world. Computer diagnoses are already used for second opinions in analysing pap smears and reading cardiac vital signs.

Conclusion

Significant hurdles remain, including legal and regulatory barriers and acceptance of the use of telemedicine by traditional medical establishments. These barriers, however, are starting to come down and there is a growing body of research data indicating how telemedicine improves patient outcomes and reduces healthcare costs.

The promise of telemedicine is providing significantly improved and cost-effective access to quality healthcare. The potential of telemedicine is helping to transform the delivery of healthcare and improve the health of millions of people throughout the world. ■